400 Seventh Street, S.W.
Washington, D.C. 20590

U.S. Department
of Transportation

**National Highway
Traffic Safety
Administration**

Dear Crash Data Researchers/Users:

Thank you for choosing crash data from the National Highway Traffic Safety Administration (NHTSA) for your research or other use. The information contained in this motor vehicle crash report is collected, maintained and distributed in accordance with Public Law 89-564. In accordance with this Public Law, NHTSA is required not to release any case information until completion of quality control procedures. These procedures include a review of the case material to extract all names, licenses and registration numbers, non-coded interview material, non-research related researcher comments in the margins, non-factual data, and the production number portion of the vehicle identification number (VIN).

If you requested NHTSA to query its database files in order to identify a specific crash, then that query was made using non-personal descriptors you provided for use in our search. This motor vehicle crash may have been identified from a data search and matches the general, non-personal descriptors you provided, but we cannot confirm that this is the specific crash report you requested.

If you have any questions with regard to the above procedures, please contact the Field Operations Branch, Crash Investigation Division, National Center for Statistics and Analysis at 202-366-4820. Again, please be advised that we cannot confirm that this is the case that you have specifically requested nor can we certify the information to be correct.

*** *** ***

TRANSPORTATION SCIENCES
CRASH DATA RESEARCH CENTER

Veridian Engineering
Calspan Operations
Buffalo, New York 14225

CALSPAN ON-SITE AIR BAG RELATED CHILD FATALITY INVESTIGATION
CALSPAN CASE NO. CA96-010
VEHICLE - 1996 DODGE CARAVAN SE
LOCATION - TENNESSEE
CRASH DATE - 1996

Contract No. DTNH22-94-07058

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
Washington, DC 20590

DISCLAIMER

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no responsibility for the contents or use thereof.

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the National Highway Traffic Safety Administration.

The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness of the involved vehicle(s) or their safety systems.

TECHNICAL REPORT STANDARD TITLE PAGE

1. *Report No.* CA96-010	2. *Government Accession No.*	3. *Recipient's Catalog No.*	
4. *Title and Subtitle* Calspan On-Site Air Bag Related Child Fatality Investigation Vehicle - 1996 Dodge Caravan SE Location - State of Tennessee		5. *Report Date*: 6. *Performing Organization Code*	
7. *Author(s)* Crash Data Research Center		8. *Performing Organization Report No.*	
9. *Performing Organization Name and Address* Transportation Sciences Crash Data Research Center Calspan Operations P.O. Box 400 Buffalo, New York 14225		10. *Work Unit No.* 11. *Contract or Grant No.* DTNH22-94-D-07058	
12. *Sponsoring Agency Name and Address* U.S. Department of Transportation National Highway Traffic Safety Administration Washington, D.C. 20590		13. *Type of Report and Period Covered* Technical Report Crash Date: 14. *Sponsoring Agency Code*	
15. *Supplementary Notes* On-site investigation of a front-to-side intersection collision that resulted in deployment of the Dodge Caravan's driver and passenger frontal air bag system and subsequent death of the front right child occupant.			
16. *Abstract* This on-site investigation focused on a two vehicle intersection crash that resulted in the death of a five (5) year old female. The child was seated in the front right position of the Dodge Caravan. The Caravan was equipped with frontal air bags for the driver and passenger positions which deployed as a result of the crash. The right front child occupant was improperly restrained by the manual 3-point lap and shoulder belt system. During the Caravan's pre-crash steering and braking maneuvers, the child was displaced forward and to the right. This placed the child in close proximity to the deploying mid mount front passenger air bag module at the time of the impact. The child further responded to the 1 o'clock direction of force and due to her forward position, altered the deployment path of the passenger side air bag. The expanding air bag contacted and abraded the child's forehead and cheek and accelerated her head rearward causing a diffuse axonal injury resulting in brain death. The child was transported from the scene by ambulance to a local hospital where she expired approximately 20 hours post-crash.			
17. *Key Words* On-site investigation Supplemental Inflatable Restraint system Air bag deployment Fatal injuries to the front right seated child passenger		18. *Distribution Statement* General Public	
19. *Security Classif. (of this report)* Unclassified	20. *Security Classif. (of this page)* Unclassified	21. *No. of Pages* 22	22. *Price*

TABLE OF CONTENTS

CALSPAN ON-SITE AIR BAG RELATED CHILD FATALITY INVESTIGATION
CALSPAN CASE NO. CA96-010
LOCATION: TENNESSEE
VEHICLE: 1996 DODGE GRAND CARAVAN SE MINIVAN
CRASH DATE:

SUMMARY

This on-site crash investigation focused on a five (5) year old female right front child occupant of a 1996 Dodge Grand Caravan SE that was equipped with frontal air bags for the driver and passenger positions. The right frontal area of the Caravan impacted the left front fender area of a 1988 Mercury Cougar in an intersection-type configuration. As a result of the crash, the Caravan's supplemental air bag system deployed. The child occupant was improperly restrained by the manual 3-point lap and shoulder belt system with the shoulder belt positioned behind her back. She was seated forward on the seat cushion and was displaced forward by the pre-crash braking, into the path of the deploying passenger air bag. The non-tethered air bag contacted and abraded the forehead and left check of the child occupant, lacerated the upper lip, and avulsed a front tooth. The expanding air bag accelerated her head in a rearward direction which resulted in cerebral edema and a diffuse axonal injury. She was displaced rearward by the bag expansion into the right door window frame and upper B-pillar. Her rebound trajectory resulted in a right lateral subdural hematoma (10 ml), posterior-parietal subgaleal hemorrhage, and a 7.6 cm (3.0 in) diameter subcutaneous contusion of the right occipital scalp. An autopsy and a microscopic examination of the brain were performed. Based upon the results of that examination, the cause of death was ruled as diffuse axonal injury (AIS-5) with cerebral edema secondary to impact with the air bag.

The 1996 Dodge Grand Caravan SE was manufactured on 6/95 and was identified by the following vehicle identification number (VIN): lB4GP44R7TB (production sequence deleted). The vehicle was equipped with continuous loop manual belt systems in the front outboard seated positions. Both belt systems were equipped with adjustable upper anchorages (D-rings) with emergency locking retractors and locking latchplates. The driver's D-ring was found adjusted to a point that was 2 cm (0.8 in) below the upper position, or 7.6 cm (3.0 in) above the bottom adjustment point yielding a total of 9.6 cm (3.8 in) of vertical adjustment. The right front D-ring was adjusted to the full down position. In addition to the frontal driver and passenger air bags, the vehicle was equipped with anti-lock (ABS) brakes.

The Dodge Caravan was traveling in a northerly direction on a two-lane street in a residential area at an estimated speed of 56 km/h (35 mph). The driver had negotiated a moderate right curve and entered a straight and level segment of road on an approach to a four-leg intersection. There were no traffic controls for north/southbound traffic flow. The Mercury Cougar was traveling in a westerly direction on the intersecting roadway on the approach to the intersection. Stop signs regulated east and westbound traffic into the intersection. The Cougar was occupied by a 17 year old female driver and four teenage female passengers. The driver and left rear occupant of the Mercury Cougar stated that they stopped at the mouth of the intersection, however, the driver either

failed to detect the approaching Dodge Caravan, or the driver rolled through the stop sign without checking for approaching traffic.

The driver of the Dodge Caravan detected the Mercury Cougar as it entered the intersection, crossing her path of travel from right to left. The driver applied a counterclockwise steering input and braked the ABS equipped Dodge Caravan in an attempt to avoid impact. There was no braking evidence on the dry asphalt road surface. It was unknown if the driver of the Cougar attempted avoidance action. The right and center frontal area of the Dodge Caravan impacted the left fender area of the Mercury Cougar. Based on impact induced loading of the front tires of the vehicles, the right front tire of the Dodge Caravan was near the center of the roadway which indicated a significant CCW steering input was initiated by the driver.

The initial impact produced direct contact damage that began 12.7 cm (5.0 in) right of center and extended 66.0 cm (26.0 in) to the right front comer of the Dodge Caravan. Crush was minimal with 3.2 cm (1.25 in) of residual displacement at the right corner of the bumper fascia and 2.0 cm (0.8 in) of crush at the corner of the bumper reinforcement bar. The Mercury Cougar sustained 50.1 cm (20.0 in) of crush located at the leading edge of the left front fender, 61.0 cm (24.0 in) forward of the left front axle position. The Mercury's direct contact damage began 8.9 cm (3.5 in) rearward of the left front axle position and extended 99.1 cm (39.0 in) forward to the front bumper comer. The left front tire and wheel were involved in the impact sequence, however, damage was minimal and was limited to the hubcap and wheel.

Resultant directions of force were within the 1 o'clock sector for the Dodge Caravan and 10 o'clock for the struck Mercury Cougar with improved PDOFs of 20 and -70 degrees respectively. The Dodge Caravan underwent a total velocity change of 20.3 km/h (12.6 mph). The longitudinal component was 18.7 km/h (11.6 mph) which was sufficient to deploy the supplemental driver and passenger side air bags. The impact rotated the Caravan in a CCW direction while the Mercury Cougar was displaced in a clockwise (CW) direction. The vehicles impacted in a sideslap configuration prior to separation. The sideslap impact was minor in severity resulting in approximately 3.8 cm (1.5 in) of sheet metal crush to the involved vehicles. The Caravan was displaced approximately 20 degrees in a CCW direction from its impact position and traveled approximately 10.7 m (35.0 ft) as it departed the northwest quadrant of the intersection. The frontal area of the vehicle impacted the northern embankment of a 86.4 cm (34.0 in) deep ditch which bordered the northwest quadrant of the intersection. Although dirt was displaced by the ditch impact, there was no structural crush to the Caravan. The Mercury Cougar traversed a shallow area of the ditch and came to rest on a grassy area approximately 16.5 m (54.0 ft) northwest of its at impact position.

The driver of the Dodge Caravan was a 39 year old female. She was properly restrained by the manual 3-point lap and shoulder belt system. Belt usage was determined by superficial webbing abrasions on the latchplate crossbar. She responded to the initial impact force and loaded the deployed driver's air bag and the manual belt webbing. Although her specific injuries were not known, the investigating police officer stated that she sustained minor abrasions from the driver's

side air bag. There was no evidence of contact (lipstick, makeup transfers) to the driver's air bag. Several blood stains were noted to the lower left quadrant of the bag. The driver's air bag deployed from a typical steering wheel mounted module assembly. The bag was tethered by internal straps and was porous in design with no direct vent ports. There was no damage to the driver's air bag.

The right front passenger of the Dodge Caravan was a 5 year old female with a reported height of 18.6 kg (41.0 in) and slender build [post-organ donation weight of 15.9 kg (35.1 lb)]. She was dressed in a pink T-shirt and floral shorts. The front right seat was positioned in a rear track position, adjusted 2.5 cm (1.0 in) forward of the full rearward position. The seat back was reclined to an angle of 20 degrees measured at a point that was 25.4 cm (10. 0 in) above the seat back/seat cushion juncture. The child occupant was improperly restrained by the manual 3-point lap and shoulder belt system. As previously noted, the adjustable D-ring was set at the lowest adjustment point. Belt usage was determined as follows:

- The outboard aspect of the polymer coating of the latchplate exhibited a faint belt loading abrasion to the crossbar.
- Blood stains were noted to the lap belt aspect of the webbing 7.6-15.2 cm (3.0-6.0 in) outboard of the latchplate with the latchplate buckled into the center mounted buckle assembly. The area of the belt extended over the abdominal area of the child occupant.
- Eight small blood stains were noted to the shoulder belt aspect of the continuous loop belt webbing 5.1-15.2 cm (2.0-6.0 in) above the buckled position of the latchplate.
- The left rear occupant of the struck Mercury Cougar exited the vehicle and ran to the aid of the child occupant. She observed the child seated in the vehicle at rest in an upright attitude with the 3-point belt system in place. She stated that the shoulder belt webbing extended high across the child occupant's chest due to her small size. This witness held the child upright and unbuckled the manual belt system as the mother (driver) removed her from the vehicle.

The child occupant was initially displaced in a forward direction by the pre-impact braking of the Dodge Caravan. The extent of her forward movement was unknown. Her pre-impact seated position was unknown, although she was probably positioned forward on the seat cushion to allow her knees to extend over the forward edge of the seat cushion. (The witness did state that at rest, the child was positioned on the seat cushion with her back extending forward of the seat back.)

As the passenger air bag deployed from the mid instrument panel, the expanding air bag contacted the child occupant's face, resulting in abrasions across the forehead and onto left cheek. Her initial involvement with the deploying air bag resulted in a laceration of the upper lip and an avulsion of an upper front tooth. The tooth was found on the upper instrument panel forward of the steering assembly.

The child occupant was in a forward position since her contact with the deploying passenger side air bag altered the deployment path of the bag. The air bag subsequently contacted the windshield and the rear view mirror. The windshield contact produced air bag fabric transfers located 35.6-54.6 cm (14.0-21.5 in) right of the vehicle's centerline and 2.5-31.8 cm (1.0-12.5 in) below the windshield header. The air bag contact also cracked the windshield 41.3 cm (16.25 in) right of center and 5.1 cm (2.0 in) below the header. An abrasion to the fabric headliner was noted at the leading edge, 27.9-33.0 cm (11.0-13.0 in) right of center that resulted from air bag contact. The rear view mirror was separated from its windshield mount and displaced to the left. The mirror contacted and deposited vinyl transfers to the windshield forward of the driver's position. There was no damage to the passenger air bag that resulted from interior contact.

The child's contact with the deploying air bag resulted in three separate blood spray patterns to the air bag. The first was located 17.8-38.1 cm (7.0-15.0 in) right of the left side of the bag and 7.6-20.3 cm (3.0-8.0 in) below the top of the bag. A second area was noted 30.4-38.1 cm (12.0-15.0 in) below the top of the bag and 0-5.1 cm (0.0-2.0 in) inboard of the right side of the bag. The third area was 54.6-58.4 cm (21.5-23.0) below the top of the bag and 14.0-21.6 cm (5.5-8.5 in) inboard of the right side. The pathologist suspected that the first blood spray pattern, which was the largest, occurred as the tooth was avulsed from the face of the child. There were no visible tissue transfers on the air bag. A small single fragment of suspected body material (tissue or nasal expulsion was noted to the lower right side panel of the bag.

The autopsy revealed the child sustained cerebral edema and a diffuse axonal injury that was attributed to acceleration induced by the expansion of the non-tethered air bag. (The pathologist removed the brain and placed the organ in a formaldehyde solution for a period of approximately two weeks to solidify the brain prior to sectioning. The suspected diffuse axonal injury of the brain was confirmed on microscopic exam.) She also sustained a right lateral subdural hematoma of 10 ml, a posterior/occipital subgaleal hemorrhage, and a large contusion of the subcutaneous tissue of the posterior scalp that resulted. from a rebound contact into the right B-pillar and door window frame. The rubber weather stripping at the vertical window frame adjacent to the B-pillar was compressed in an outboard direction 11.4-14.0 cm (4.4-5.5 in) above the beltline. There were no injuries to the anterior neck, cervical spine, or skull.

Following the crash, the child passenger was transported by ambulance to a local hospital where she was evaluated and placed on a respirator. She was subsequently diagnosed as brain dead and expired approximately 20 hours post-crash.

A two year old female passenger was secured in a Century 3000 forward facing child restraint that was belted into the left rear seat position of the Caravan. The second seat separated from the floor attachment points during the crash, however, there was no damage to the mounting/locking mechanisms, therefore it was doubtful that the seat was properly secured to the vehicle pre-crash. The two year old child occupant was not injured in the crash and remained in the child restraint.

CALSPAN ON-SITE AIR BAG RELATED CHILD FATALITY INVESTIGATION
CALSPAN CASE NO. CA96-010
LOCATION: TENNESSEE
VEHICLE: 1996 DODGE GRAND CARAVAN
CRASH DATE: SEPTEMBER 1996

CRASH DATA

Location:	4-leg intersection
State:	Tennessee
Area/Type:	Urban/Residential
Crash Date/Time:	/daylight hours
Investigating Police Agency:	City Police Department
Crash Type:	Minivan/car, front-to-side impact configuration with subsequent sideslap
Air Bag Vehicle Occupant Injury Severity:	Driver - Minor (AIS-1) Front Right Child Passenger - Critical (AIS-5) Second Seat Child Passenger - Not Injured

AMBIENCE

Viewing Conditions:	Daylight
Weather:	Clear
Precipitation:	None
Road Surface:	Dry

HIGHWAY

	Air Bag Vehicle	Vehicle #2
Type:	Local street	Local street
Number of Lanes:	2	2
Width:	6.4 m (20.9')	5.9 m (19.3')

HIGHWAY (CONT'D.)

	Air Bag Vehicle	Vehicle #2
Surface:	Asphalt	Asphalt
Median:	None	None
Edge:	0.5 m (1.6 ft) stone/grass	Grass
Vertical Alignment:	Level	Hillcrest 94 m (310') prior to intersection
Horizontal Alignment:	Right curve terminating to straight segment 61 m (200 ft) prior to intersection	Straight
Estimated Coefficient of Friction:	0.7	0.7
Traffic Density:	Light	Light

TRAFFIC CONTROLS

Signals:	None	None
Signs:	None	Stop Sign
Markings:	Solid double yellow centerline, solid white road edge lines	Solid double yellow centerline, solid white road edge lines
Speed Limit:	56 km/h (35 mph)	48 km/h (30 mph)

VEHICLES

	Air Bag Vehicle
Description:	1996 Dodge Grand Caravan SE minivan
V.I.N.:	lB4GP44R7TB (production sequence deleted)
Date of Manufacture:	6/95
Color:	Silver
Engine:	3.3 liter, V-6

VEHICLES (CONT'D.)

Air Bag Vehicle

Transmission:	4-speed automatic, column mounted shifter
Steering:	Power-assisted rack and pinion
Brakes:	Power assisted front disc, rear drum with 4-wheel anti-lock (ABS)
Padding:	Upper and mid instrument panel, sunvisors, soft-edged steering wheel rim, door panels, door armrests, integral head restraint and fold-down center armrests
Manual Restraints:	3-point lap and shoulder belt systems in the 6 outboard seated positions which consisted of emergency locking retractors with continuous loop belt webbing and locking latchplates, adjustable upper anchorages for the front seat belt systems (D-rings), 3rd seat center lap belt
Automatic Restraints:	Supplemental Restraint System (SRS) that consisted of frontal air bags for the driver and front right passenger positions which deployed as a result of the crash
Tow Status:	Towed due to vehicle damage

Vehicle #2

Description:	1988 Mercury Cougar, 2-door sedan
V.I.N.:	IMEBM6043JH (production sequence deleted)
Date of Manufacture:	3/88
Color:	Black
Engine:	V-6
Transmission:	3-speed automatic
Steering:	Power-assisted rack-and-pinion
Brakes:	Power-assisted front disc/rear drum, no anti-lock
Tow Status:	Towed due to vehicle damage

VEHICLE DAMAGE

Air Bag Vehicle

Exterior:

The 1996 Dodge Grand Caravan SE sustained moderate damage to the front right area of the vehicle as a result of its impact sequence with the left front side area of the 1988 Mercury Cougar. The direct contact damage began 12.7 cm (5.0 in) right of center and extended 66.0 cm (26.0 in) to the front right corner. Maximum residual crush was 3.3 cm (1.25") located at the right corner of the bumper reinforcement bar. The documented crush profile over the full width of the reinforcement bar was a s follows: C1=0, C2=0, C3=0, C4=0.6 cm (0.25 in), C5=1.0 cm (0.38 in), C6=3.3 cm (1.25 in). Damaged components included the front bumper fascia, bumper reinforcement bar, hood, right headlamp assembly, and the right front fender.

Secondary damage resulted from a subsequent sideslap impact with the Mercury Cougar. The direct contact damage began 66.8 cm (23.6 in) aft of the right rear axle and extended forward 265.4 cm (104.5 in). A maximum lateral deformation of 3.2 cm (1.25 in) was located 54.6 cm (21.5 in) forward of the right rear axle at the base of the C-pillar. The superficial crush profile was a follows: C1=0 cm, C2=1.9 cm (0.75 in), C3=0.6 cm (0.25 in), C4=1.3 cm (0.5 in), C5=0 cm, C6=0 cm.

As the Caravan came to rest, the front right undercarriage area impacted a drainage ditch which abraded the underside of the bumper fascia. The contact damage began at the right corner of the fascia and extended 115.6 cm (45.5 in) to the left. The air dam aspect of the fascia was displaced upward approximately 3.8 cm (1.5 in).

CDC:	**Event No.**	**Object Struck**
01-FYEW-1	Event 1	Mercury Cougar
03-RDEW-1	Event 2	Mercury Cougar
12-FDLW-3	Event 3	Ditch

Repair Cost: Estimated $8,000

Interior:

Interior damage to the Dodge Caravan was limited to deployment of the Supplemental Restraint System and occupant contact points located primarily on the passenger side of the vehicle. The driver's air bag displayed nine (9) blood spatters at the lower left quadrant located 6.4-12.7 cm (2.5-5.0 in) below the horizontal centerline and 5.7-13.7 cm (2.3-5.4 in) left of center. There were no lipstick or makeup transfers on the bag, although dirt-like transfers were noted over the face of the bag. These transfers appeared to have resulted from post-crash handling of the air bag. There was no loading evidence on the driver's seat belt

webbing, however, the latchplate crossbar exhibited a 1.3 cm (0.5 in) webbing abrasion to the polymer coating at the forward 25 percent of the crossbar.

The deployment path of the passenger side air bag was altered by the forward position of the front right child passenger which resulted in bag contact to the windshield, headliner, and the rear view mirror. A large air bag fabric transfer was located to the windshield 35.6-54.6 cm (14.0-21.5 in) right of the vehicle's centerline and 2.5-31.8 cm (1.0-12.5 in) below the windshield header (refer to Photograph No. 66). A windshield spider web-type cracked was located 41.3 cm (16.25 in) right of center and 5.1 cm (2.0 in) below the headliner (refer to Photograph No. 65-67). Also, an air bag fabric abrasion was located on the headliner 27.9-33.0 cm (11.0-13.0 in) right of center which extended 1.3-5.1 cm (0.5-2.0 in) rearward (refer to Photograph No. 68).

Expansion of the front right air bag resulted in contact and separation of the rear view mirror from its windshield mount. The bag displaced the separated mirror across the left side of the windshield which resulted in six (6) vinyl scuff marks to the windshield. These scuffs were located 21.6-59.7 cm (8.5-23.5 in) left of center and 51.-19.1 cm (2.0-7.5 in) below the windshield header. The mirror came to rest on the upper instrument panel adjacent to the left A-pillar.

Three blood spatter patterns were located on the face of the front right passenger air bag. The first spatter was located 17.8-38.1 cm (7.0-15.0 in) inboard of the left side of the air bag and 7.6-20.3 cm (3.0-8.0) below the top of the bag. The second blood spatter was noted 30.5-38.1 cm (12.0-15.0 in) below the top of the bag and 0.0-5.1 cm (0.0-2.0 in) inboard of the right side of the bag. A third blood spatter was 54.6-58.4 cm (21.5-23.0 in) below the top of the bag and 14.0-21.6 cm (5.5-8.5 in) inboard of the right side. The Medical Examiner suspected that the spatters possibly resulted from the dislocation of a tooth from the child passenger. An additional trail of blood spatters were noted to the headliner above the front right seat (refer to Photograph No. 77). A body material (tissue or nasal expulsion) transfer which measured 12.7 cm (5.0 in) was located on the right side of the passenger air bag, centered between the side seams and 7.6 cm (3.0 in) above the lower seam.

The posterior scalp of the front right child passenger impacted the right upper B-pillar and door window frame during her rebound trajectory. The rubber strip at the trailing edge of the right front door window was deformed by the head contact. The deformed area of the gasket involved 5.0 mm (0.2 in)of compression. The compression was located 11.1-13.7cm (4.4-5.4 in) above the beltline and 47.0 cm (18.5 in) above the seat cushion (refer to Photograph No.93-95). A dark oily smudge was noted on the B-pillar 17.1-18.4 cm (6.75-7.25 in) above

Interior (Cont'd):

Air Bag Vehicle

the beltline and 1.9-3.5 cm (0.75-1.4 in) outboard of the inside face of the pillar, approximately 53.3 cm (21.0 in) above the seat cushion.

Additional transfers included a stain-like mark on both sides of the front right seat belt webbing 88.9-113.0 cm (35.0-44.5 in) above the floor anchorage. Also, eight (8) small blood spatters were noted to the outside edge of the shoulder belt webbing and were located 90.8-100.3 cm (35.75-39.5 in) above the floor anchorage. With the system buckled, these transfers would be approximately 5.1-15.2 cm (2.0-6.0 in) above the latchplate.

The left side mounting point of the second seat (removable) completely disengaged from the floor locking point (refer to Photograph No. 97). A toddler was restrained in a forward facing child safety seat in the left side of the second seat. The shoulder belt at this position sustained a large abrasion from the plastic extrusion at the outboard aspect of the seat cushion/seat back juncture. The abrasion measured 11.4 cm (4.5 in) vertical and 3.8 (1.5 in) horizontal (refer to Photograph No. 102-103). An additional D-ring transfer was noted on the webbing located 195.6 cm (77.0 in) above the floor anchorage.

Vehicle #2

Exterior:

The 1988 Mercury Cougar sustained moderate left side damage from its impact sequence with the Dodge Caravan. The direct contact damage began 8.9 cm (3.5 in) rearward of the left front axle and extended 99.1 cm (39.0 in) forward to the front bumper corner. The combined induced and direct contact damage began at the trailing edge of the left front fender and extended 141.5 cm (55.75 in) forward to the bumper comer. Maximum crush was 50.1 cm (20.0 in) located at the leading edge of the left front fender, 61.0 cm (24.0 in) forward of the left front axle. The crush profile was as follows: C1 =0, C2= 13.0 cm (5.1 in), C3=22.9 cm (9.0 in), C4=34.3 cm(13.5 in), C5=35.8 cm (14.1 in), C6=27.4 cm (10.8 in).

The secondary sideslap damage was minor with a maximum crush of 4.8 cm (1.9 in) located 17.1 cm (6.75 in) forward of the left rear axle. The direct contact damage began 81.3 cm (32.0 in) rearward of the left rear axle and extended 245.1 cm (96.5 in) forward. The crush profile for the sideslap was as follows: Cl=0 cm, C2=3.3 cm (1.3 in), C3=4.8 cm (1.9 in), C4=0.6 cm (0.3 in), C5=0.3 cm (0.1 in), C6=0 cm. The left side rear view mirror, located 91.4 cm (36.0 in) rearward of the left front axle, was fractured by the secondary impact.

CDC:	Event No.	Object Contacted
10-LFEW-3	Event I	Air bag vehicle
09-LZEW-1	Event 2	Air bag vehicle

AUTOMATIC RESTRAINT SYSTEM

The 1996 Dodge Grand Caravan was equipped with a Supplemental Restraint System (SRS) that consisted of frontal air bags for the driver and passenger positions. The air bags deployed as a result of the intersection-type crash sequence with the 1998 Mercury Cougar. The driver air bag was incorporated within the steering wheel assembly in a typical configuration while the passenger air bag was mounted in a mid-mount configuration within the right instrument panel.

The driver air bag deployed as designed from an H-configuration air bag module cover assembly that was contained within the 3-spoke steering wheel rim. The three spokes were located at the 4, 6, and 8 o'clock positions. The right and left side spokes contained the cruise control activation switches. The tilt steering column had six (6) adjustment positions and was found adjusted to the second position from the top.

The H-configuration module cover flaps were hinged horizontally with a center tear seam (refer to Photograph No. 51). The hinge point of the upper flap was 13.3 cm (5.25 in) wide and the center tear seam was 17.6 cm (6.9 in) in width. The lower cover flap height was 9.5 cm (3.75 in). The horn contact pad was positioned within the cover flap. The deployed driver air bag was approximately 63.5 cm (25.0 in) in diameter, seam-to-seam (refer to Photograph No. 52). The bag was tethered with two (2) internal tethers at the 3 and 9 o'clock positions. A 15.2 cm (6.0 in) diameter tether reinforcement was sewn to the center face of the bag with two (2) rows of stitching that were separated by 5.0 mm (3/16 in). There was 20.3 cm (8.0 in) of bag excursion at the tether points with the bag in its deflated state. The driver's side air bag was not directly vented into the passenger compartment. The bag was constructed with two separate fabrics, with the forward fabric being of a lighter weight. A bar coded label at 12 o'clock position on the driver bag identified the unit with the following alpha-numeric sequence:

There was no damage to the deployed driver air bag. There were no lipstick or makeup transfers on the bag, however, numerous dirt/grease-type transfers were noted over the face of the bag which appeared to have resulted from post-crash handling of the bag. In addition, nine (9) blood spatters were documented on the lower left quadrant, 6.4-12.7 cm (2.5-5.0 in) down and 5.7-13.7 cm (2.25-5.4 in) left of center (refer to Photograph No. 53). These probably resulted from expulsion of blood from the right front child passenger or from the driver attending to the passenger immediately following the crash.

Warning labels were visible on both sunvisors, visible with the visor in the stowed position. The dimensions of the label were 11.4 x 5.1 cm (4.5 in x 2.0 in). The labels advised the following:

CAUTION
TO AVOID SERIOUS INJURY

- For maximum safety protection in all types of crashes, you must always wear your safety belt.
- Do not install rearward-facing child seats in any front passenger position. Do not sit or lean unnecessarily close to the air bag.
- Do not place any objects over the air bag or between the air bag and yourself.
- See the owner's manual for further information and explanations.

The passenger air bag was a mid-mount configuration (refer to Photograph No. 62). The upper and lower flaps of the passenger side air bag was constructed with an ABS-type plastic inner shell with a full sheet-metal reinforcement that acted as a hinge. At the hinge point of both upper and lower flaps, the sheet-metal had four (4) slots; the two inboard slots were 3.5 x 1.0 cm (1.37 x 0.37 in) and the two outboard slots were 3.2 x 1.0 cm (1.25 x 0.37 in). Both flaps were covered with 5.0 mm (3/16 in) of foam with an outer vinyl instrument panel skin on top. The upper flap was 28.6 cm (11.25 in) wide and 6.0 cm (2.375 in) high and the lower flap was 27.9 cm (11.0 in) wide and 5.4 cm (2.1 in) high. The following bar coded label was affixed to the inside of the upper flap:

NS UPPER SIR DOOR

The lower module cover flap had the following bar coded label affixed the inside surface of the lower flap:

NS LOWER SIR DOOR

At the time of the inspection, the upper flap was opened approximately 180 degrees to a near vertical position. In this full open position, the flap was rigid. The lower flap was opened at a 90 degree angle to the instrument panel, parallel to the floor and extended 5.4 cm (2.125 in) out from the mid panel.

The front passenger air bag was not tethered. The bag, in its deflated state, measured 43.2 cm (17.0 in) vertically and 61.0 cm (24.0 in) horizontally (refer to Photograph No. 64). The maximum excursion of the bag into the passenger compartment was 70.0 cm (27.5 in) at the midpoint and approximately 55.9 cm (22.0 in) at the top and bottom aspects (refer to Photograph No. 82). The unvented bag was constructed with two (2) fabrics, with the forward fabric consisting of a lighter weight material.

Three blood spatter patterns were noted to the front right air bag. The first spatter was located 17.8-38.1 cm (7.0-15.0 in) right of the left side of the air bag and 7.6-20.3 cm (3.0-

8.0 in) down from the top of the bag (refer to Photograph No. 70). The second blood spatter was noted 30.5-38.1 cm (12.0-15.0 in) below the top of the bag and 0.0-5.1 cm (0.0-2.0 in) inboard of the right side of the bag (refer to Photograph No. 73). A third blood spatter was located 54.6-58.4 cm (21.5-23.0 in) below the top of the bag and 14.0-21.6 cm (5.5-8.5 in) inboard of the right side (refer to Photograph No. 72). A probable body fluid/material (tissue or nasal expulsion) transfer of 12.7 cm (5.0 in) in length was located on the right side of the passenger side air bag, centered between the side seams and 7.6 cm (3.0 in) above the lower seam. Gray vinyl transfers were present at the bottom right sector of the bag 13.3-5.1 cm (5.15-2.0 in) up from the bottom seam and 7.0-17.8 cm (2.75-7.0 in) left of the right seam (refer to Photograph No. 74-75). These resulted from bag expansion within the module assembly.

MANUAL RESTRAINTS

The 1996 Dodge Caravan was equipped with manual 3-point lap and shoulder belts in the six outboard seated positions. The front seat belt systems consisted of a continuous loop lap and shoulder belt webbings with locking latchplates. Emergency locking retractors were mounted in the base of each B-pillar. The belt systems utilized an adjustable upper anchorage (D-ring). The driver's D-ring was found adjusted to a point that was 2.0 cm (0.8 in) below the full up position, or 7.6 cm (3.0 in) above the bottom adjustment point, yielding a total of 9.6 cm (3.8 in) of vertical adjustment. The driver was wearing the manual 3-point shoulder belt. Routine usage marks present on the latchplate. There was no loading evidence on the driver's seat belt webbing, however, the latchplate crossbar exhibited a 1.3 cm (0.5 in) abrasion to the polymer coating at the forward aspect of the crossbar (refer to Photograph No. 59).

The 5 year old child passenger was seated in the right front position and was restrained by the lap portion of the restraint with the shoulder belt probably positioned behind her back. The right front D-ring was adjusted to the full down position (refer to Photograph No. 85). A faint abrasion was noted on the outboard aspect of the plastic crossbar of the latchplate (refer to Photograph No.88). There were blood stains noted 7.6-15.2 cm (3.0-6.0 in) outboard of the latchplate on the lap portion of the webbing. There were also eight (8) small blood stains noted on the shoulder aspect of the belt webbing (refer to Photograph N. 87). The stains were located 5.1-15.2 cm (2.0-6.0 in) above the latchplate. These stains probably were deposited after the child rebounded back under the shoulder belt webbing in the later stages of the crash sequence. A fluid spill was also noted on the right front restraint webbing (refer to Photograph Nos. 89-92), however, this did not appear to be related to the crash.

A second child passenger was positioned in a forward facing child safety seat which was secured by the 3 -point lap and shoulder belt system in the left rear position of the second seat. Although the child occupant did not directly load the belt system during the crash, the second seat separated from the floor mounted anchorages. As the seat disengaged from the floor, the belt restrained the forward movement of the left side of the seat and retained the

child safety seat on the seat cushion. Abrasions were noted to the shoulder belt webbing and to the plastic extrusion at the seat cushion/seat back juncture. In addition, the loading produced a D-ring transfer to the shoulder belt webbing. This evidence is documented in Photograph Nos. 97-102.

COLLISION SEQUENCE

Pre-Crash:

The driver of the 1996 Dodge Caravan had driven from her residence to pick up her 5 year old daughter from school. She estimated the distance from home to school at 6.4 km (4.0 miles). On the return trip, she was traveling in a northerly direction on the two-lane roadway at a driver estimated speed of 53-56 km/h (33-35 mph). She had negotiated a right curve with respect to vehicle's travel path and was approaching a four-leg intersection. There were no traffic controls for north/southbound traffic flow through the intersection. The intersection was level and open which afforded the driver a clear line of sight of approaching vehicles.

The 1988 Mercury Cougar was driven by a 17 year old female and was occupied by four additional teenage females. The students had departed the local high school and were traveling in a westerly direction, approaching the above mentioned intersection from the east. The posted speed limit for the east/westbound traffic flow was 48 km/h (30 mph). Stop signs regulated east and westbound traffic flow through the intersection. There were conflicting statements from both driver's regarding the travel of the Cougar through the intersection. The driver of the Dodge Caravan detected the Cougar on the approach intersection, however, she noted that the driver of the Cougar failed to stop for the stop sign and entered the intersection directly into the path of the Caravan. The driver of the Mercury Cougar stated to the investigating police officer that she stopped for the regulatory stop sign, checked for approaching north/southbound traffic, then proceeded through the intersection without detecting the Dodge Caravan until it was too late to initiate avoidance action.

The driver of the Dodge Caravan observed the Mercury Cougar as it entered the intersection. She applied a counterclockwise steering input and braked the ABS equipped Dodge Caravan in an attempt to avoid impact. The avoidance maneuvers redirected the Caravan toward the center of the north/southbound roadway.

Crash:

The front center and right area of the Dodge Caravan impacted the left front fender area of the Mercury Cougar resulting in a 1 o'clock/ 10 o'clock impact configuration. Impact speeds were computed at 45 km/h (28 mph) for the Dodge Caravan and 25.7 km/h (16.0 mph) for the struck Mercury Cougar. As a result of the impact, the Dodge Caravan underwent a total velocity change of 20.3 km/h (12.6 mph) with a longitudinal component of 18.7 cm (11.6 mph) and a lateral component of 8.0 km/h (5.0 mph). The longitudinal component was sufficient to deploy the Dodge Caravan's supplemental frontal driver and passenger air bag system.

The impact rotated the Dodge Caravan in a counterclockwise (CCW) direction while the Mercury Cougar was displaced in a clockwise (CW) direction. The vehicles subsequently impacted in a sideslap configuration resulting in lateral impact forces of 3 o'clock and 9 o'clock for the Dodge and Mercury respectively. The Dodge Caravan was displaced approximately 20 degrees in a CCW direction from its initial impact position and traveled approximately 10.7 m (35.0 ft) as it departed the northwest quadrant of the intersection.

The front undercarriage area of the Caravan impacted the north embankment of a drainage ditch that paralleled the west leg of the intersection. The ditch was 21.1 m (7.0 ft) in width with a depth of approximately 86.4 cm (34.0 in). The latter impact sequence displaced an area of sod from the embankment and crush the integral front air dam to a depth of 3.8 cm (1.5 in).

Post-Crash:

Final Rest - The Dodge Caravan came to rest with its frontal area engaged against the northern embankment of an 86.4 cm (34.0 in) deep ditch which bordered the perimeter of the northwest quadrant of the intersection. The Mercury Cougar traversed a shallow area of the ditch and came to rest on a grassy area approximately 16.5 m (54.0 ft) northwest of its at impact position. At rest, both vehicles were facing in a northwesterly direction.

Driver Activities - Immediately following the crash, the driver of the Dodge Caravan observed that her 5 year old daughter was not responding. She exited the vehicle unassisted from the left front door and proceeded to the right side of the Caravan. The left rear passenger of the Mercury Cougar exited the vehicle and ran to the right front door area of the Caravan. She unbuckled the front right occupant's seat belt system and the mother (driver) removed the child from the vehicle. The driver and remaining passengers of the Cougar exited the vehicle and waited for emergency personnel to arrive on-scene.

Rescue Activities - The passenger of the Mercury Cougar checked the child's airway and her breathing prior to the arrival of the paramedics. On-scene, paramedics prepared the 5 year old child occupant for ambulance transport to a regional trauma center where she was admitted to the trauma unit. She was subsequently diagnosed with brain death and expired

Post-Crash (Cont'd):

approximately 20 hours post-crash. The driver and the 2 year old rear seat passenger of the Caravan were transported by the ambulance to the hospital. Two of the 5 occupants of the Mercury Cougar were transported by private vehicle to a local hospital for examination of possible injury and released.

Scene Clearance - The Dodge Caravan and the Mercury Cougar sustained disabling damage and were towed from the scene of the crash following the extensive on-scene police investigation. The Caravan was impounded by the local police department and retained for our inspection.

HUMAN FACTORS/OCCUPANT DATA

Air Bag Vehicle

Driver:	39 year old female
Height:	175.3 m (69.0 in)
Weight:	62.6 kg (138.0 lbs)
Manual Restraint Usage:	3 -point lap and shoulder belt
Usage Source:	Vehicle inspection
Eyewear:	Unknown
Mode of Transport From Scene:	Ambulance
Type of Medical Treatment:	Transported to local hospital where she was treated for minor injuries and released
Vehicle Familiarity:	12 months
Route Familiarity:	Resident of area
Trip Plan:	School to home

DRIVER INJURIES

Injury	Injury Severity (AIS-90)	Injury Mechanisms
Minor abrasions, unspecified region	Minor (990200.1,9)	Restraint systems

DRIVER KINEMATICS

The driver of the 1996 Dodge Caravan was presumably seated in a normal posture at impact with her seat adjusted 2.2 cm (0.875 in) forward of the full rearward position. Her seat back was reclined 21.5 degrees rearward of vertical. She was properly restrained by the manual 3-point lap and shoulder belt system. There was no direct evidence of driver loading on the belt system, however, the latchplate was abraded from interaction with the webbing as a result of driver loading.

At impact with the Mercury Cougar the frontal air bag system deployed. The driver initiated a forward trajectory in response to the 1 o'clock impact force and loaded the manual belt webbing and the deployed air bag. As a result of restraint or air bag loading, the driver sustained minor unspecified abrasions.

FRONT RIGHT PASSENGER DATA

Age/Sex:	5 year old female
Height:	104.1 cm (41. 0 in)
Weight:	15.9 kg (35.1 lb) post-organ donation weight
Manual Restraint Usage:	Improper usage of the 3-point lap and shoulder belt system
Usage Source:	Vehicle inspection
Eyewear:	None reported
Mode of Transport From Scene:	Ambulance
Type of Medical Treatment:	Transported to a regional trauma center where she was diagnosed with brain death. The child expired approximately 20 hours post-crash

FRONT RIGHT PASSENGER INJURIES

Injury	Injury Severity (AIS-90)	Injury Mechanism
Diffuse axonal injury (Grade 1)	Critical (140628.5,9)	Acceleration by the deploying front passenger air bag
Small subdural hematoma of the right parietal/occipital area	Severe (140652.4,6)	Rebound contact into the right B-pillar and door window frame
Epidural hemorrhage, not further specified	Severe (140630.4,9)	Rebound contact into the right B-pillar and door window frame
Cerebral edema of the right parietal area	Serious (140668.3,1)	Acceleration by the deploying front passenger air bag
Superficial abrasions of the forehead	Minor (297020.1,7)	Deploying front passenger air bag
Superficial abrasions below the left eye	Minor (297202.1,2)	Deploying front passenger air bag
Focal hemorrhage of the occipital scalp and galea	Minor (190402.1,6)	Rebound contact into the right B-pillar and door window frame
Superficial contusion over the right anterior shoulder	Minor (790402.1,1)	Shoulder belt webbing
Avulsed front tooth (unspecified)	Minor (251406.1,8)	Deploying front passenger air bag
Contusion of the posterior scalp extending into the subcutaneous tissue, 7.6-10.2 cm (3.0-4.0 in) in diameter	Minor (1 90402.1,6)	Rebound contact into the right B-pillar and door window frame
Lacerated lower lip	Minor (290600.1,8)	Deploying front passenger air bag

* Source of Injury Data - Autopsy report

FRONT RIGHT PASSENGER KINEMATICS

The 5 year old child passenger was seated in the front right position of the Dodge Caravan. The captain's style seat was adjusted to a rear track position, 2.5 cm (1.0 in) forward of full rearward with the seat back reclined 20 degrees. The horizontal distance between the mid mount passenger air bag module assembly and the seat back was 78.7 cm (31.0 in). The child was probably seated in a forward position on the seat cushion to allow her knees to extend over the forward edge of the cushion. In this position, her upper body was forward of the seat back. The child occupant was restrained by the manual belt system, however, she was improperly restrained with the shoulder belt positioned behind her back. Her mother stated that the child typically worn the belt in this position due to her short stature which caused the shoulder belt to extend across her face. She further noted that the child always "buckled up" as she entered the vehicle. Belt usage, although improper, was confirmed by a faint abrasion on the polymer coating to the crossbar of the latchplate (refer to Photograph No. 88) and numerous blood stains on the belt webbing. The adjustable upper anchorage (D-ring) was found adjusted to the lowest position. She was dressed in a pink T-shirt with short sleeves and floral shorts.

The driver of the Dodge Caravan applied a CCW steering input and braked the ABS equipped vehicle in an attempt to avoid the impending impact. The child passenger responded to the vehicle's pre-crash turning and braking maneuvers by initiating a forward trajectory with respect to the vehicle. The lap belt restrained her pelvic region which allowed her head and torso to pitch forward and downward toward the mid mount passenger air bag module assembly. This trajectory positioned her face/head within a close proximity to the passenger air bag module and into the path of the deploying air bag.

At impact with the Mercury Cougar, the Caravan's frontal air bag system deployed. The expanding passenger air bag membrane impacted the child's face which resulted in superficial abrasions of the forehead and left face, distal to the eye. The expanding air bag contacted the mouth area of the child which resulted in a lacerated lip, an avulsion of a front tooth, and dislocation of several additional teeth. The avulsed tooth was found on the upper instrument panel forward of the steering assembly. Several blood spatter patterns were noted to the bag that may have been related to the avulsion, however, these spray patterns appeared to have occurred from the expulsion of blood during breathing.

The forward position of the child occupant pre-crash, altered the normal deployment path of the air bag, deflecting the bag upward into the windshield and rearview mirror. Bag contact with the glazing was evidence by air bag fabric transfers on the glass and a fracture to the windshield. The rearview mirror was subsequently separated from its mount and displaced to the left.

The expanding air bag accelerated the child occupant in a rearward direction as the vehicle rotated in a clockwise direction. The rapid acceleration due to the deployment resulted in

a Grade 1 diffuse axonal injury (AIS-5) which the medical examiner identified as immediate and unrecoverable death. In addition, she sustained diffuse cerebral edema.

The rearward displacement of the child by the expanding air bag resulted in a rebound-type trajectory and contact sequence with the right B-pillar/door window frame. This trajectory occurred as the vehicle was displaced in a CCW direction by the initial (1 o'clock impact force) impact sequence and the subsequent sideslap with vehicle #2. As a result, the child moved on a trajectory that was rearward and lateral to her right with respect to the displaced vehicle. The posterior aspect of her scalp impacted the lower third aspect of the right B-pillar and door window frame. The contact sequence was evidence by a concave compression of the gasket for the right front door window (refer to Photograph No. 94). As a result of the rearward displacement by the expanding passenger air bag and the subsequent contact with the door window frame, the child sustained a contusion of the posterior scalp that extended into the subcutaneous tissue, a focal hemorrhage of the occipital scalp and galea, and a small subdural hematoma of the right parietal/occipital area, and small subdural hematoma, and focal hemorrhage of the scalp and galea with epidural hemorrhage (unspecified regions).

Due to the child's presumed forward pre-crash position on the seat cushion, excess belt webbing was probably spooled out of the retractor which allowed her to gain the forward position. During her rebound trajectory and subsequent head contact with the right B-pillar area, the head and torso area of the child traveled between the diagonally extended shoulder belt webbing that was positioned behind her back and the right B-pillar. This trajectory, in combination with her small stature, allowed her head and torso to travel rearward of the extended shoulder belt webbing.

As the Caravan disengaged from the Cougar, it traveled in a forward direction and departed the northwest quadrant of the intersection. The frontal undercarriage area of the Caravan impacted a ditch bordering the intersection and came to rest in a nose-down attitude in the ditch. The child passenger responded to the subsequent frontal impact force by moving forward and upward with respect to the vehicle's trajectory. As she moved forward from her position against the B-pillar, her body was positioned behind the extended shoulder belt webbing and she subsequently loaded the belt system with her torso area. Belt loading was evidence by the latchplate abrasion and a medical examiner reported linear soft tissue contusion to the anterior aspect of the right shoulder. The belt system prevented her from contact with frontal components and from involvement with the deflating passenger air bag. In addition, the belt system held the child occupant within the right front seat position.

As the vehicles came to rest, the left rear passenger of the Mercury Cougar exited the vehicle and ran to the right side of the Dodge Caravan. She opened the right front door and observed the child occupant seated in an upright attitude in the right front position of the vehicle, leaning forward against the should belt webbing. She noted that the shoulder belt webbing was positioned across the child's chest with the webbing extending across the facial area.

This witness stated that the child occupant was bleeding from the nose and mouth with a visible soft tissue injury to the forehead area. She further noted that the occupant appeared to have been holding herself upright with both hands positioned on the armrests to the captain's chair. This witness reached in the vehicle with her right arm and unbuckled the manual restraint with her right hand while holding the child upright with her left arm. She stated that the belt was easily removed from the frontal area of the child. The driver of the Caravan subsequently removed the right front child passenger from the right front door of the vehicle and laid her on the ground. She was subsequently transported by ambulance to a local hospital where she was diagnosed with brain death. She expired approximately 20 hours post-crash.

LEFT REAR PASSENGER DATA

Age/Sex:	2 year old female
Height:	Unknown
Weight:	11.3 kg (25.0 lb)
Manual Restraint Usage:	Restrained in a forward facing Century child safety seat that was secure by the vehicle's 3-point belt system
Usage Source:	Vehicle inspection, police report, driver interview
Medical Treatment:	Not injured

LEFT REAR PASSENGER INJURIES

Injury	Severity (AIS-90)	Injury Mechanism
Not injured	N/A	N/A

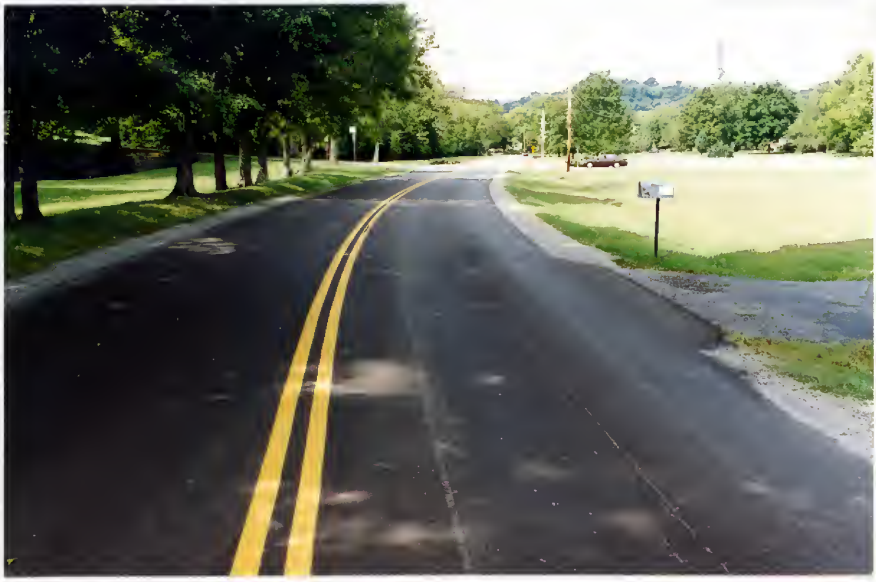
LEFT REAR PASSENGER KINEMATICS

The child passenger was positioned in a forward facing Century child safety seat that was secured by the vehicle's manual 3 -point lap and shoulder belt system in the left rear (second seat) of the Caravan. The two position bench seat was removable and had been removed on several occasions by the family prior to the crash. The second seat was reinstalled, however, it was unknown if it had been properly locked to the floor anchorages. During the crash sequence, the second seat disengaged from the floor anchorages and move in a forward direction by the belt system that secured the child safety seat into the outboard seated position. The belt system retained the child safety seat and therefore, the child was not injured in the crash.

The shoulder belt loaded against the plastic extrusion on the outboard side of the seat, abrading both the belt webbing and the extrusion. In addition, the shoulder belt webbing loaded against the D-ring which produced a D-ring transfer on the belt webbing (refer to Photographs Nos. 97-102).

ATTACHMENT A

Color Prints



1. Northbound view of the Dodge Caravan's initial approach to the crash scene.

2. Dodge Caravan's approach view at 61 meters (200 feet) from point of impact (POI).

3. Dodge Caravan's view of Mercury Cougar's approach path at 61 meters (200 feet).

4. Dodge Caravan's approach view at 46 meters (150 feet) from the POI..

3. Dodge Caravan's view of Mercury Cougar's approach path at 61 meters (200 feet).

4. Dodge Caravan's approach view at 46 meters (150 feet) from the POI..

7. Dodge Caravan's approach view at 15 meters (50 feet) from crash impact point.

8. Dodge Caravan's view of Mercury Cougar's approach path at 15 meters (50 feet).

9. View of the POI.

10. Post impact trajectory of the Dodge Caravan.

11. View of final rest position of Dodge Caravan and Mercury Cougar.

12. View of the embankment impacted by the front of the Dodge.

13. Westward view along the ditch line.

14. Look back view of from the Dodge Caravan's rest position.

15. View of the Mercury Cougar's approach into the intersection at the hill crest.

16. Mercury Cougar's approach view at 74 meters (243 feet) from the POI.

17. Mercury Cougar's view of Dodge Caravan's approach path at 74 meters (243 feet).

18. Mercury Cougar's approach view at 61 meters (200 feet) from the POI.

19. Mercury Cougar's view of Dodge Caravan's approach path at 61 meters (200 feet).

20. Mercury Cougar's approach view at 46 meters (150 feet) from the POI.

21. Mercury Cougar's approach view at 30 meters (100 feet) from the POI.

22. Mercury Cougar's view of Dodge Caravan's approach path at 30 meters (100 feet).

23. Mercury Cougar's approach view at 15 meters (50 feet) from the POI.

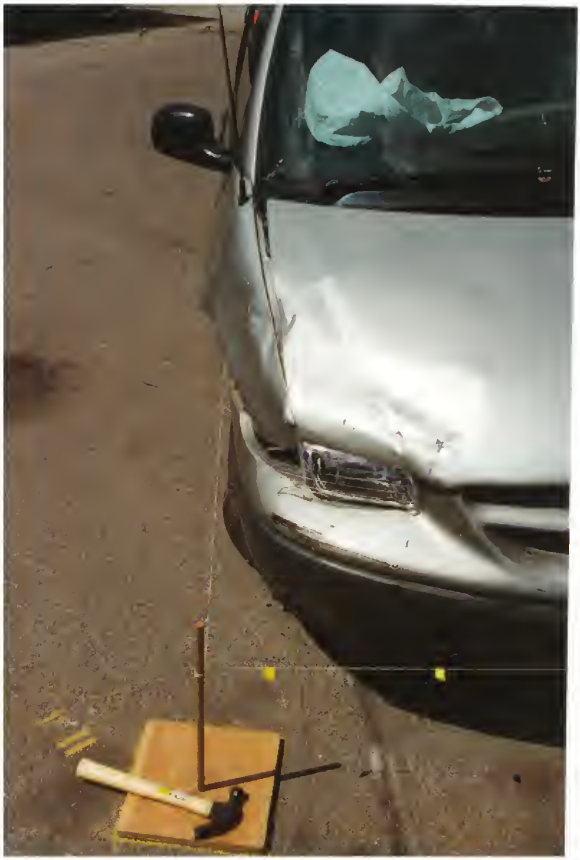
24. Mercury Cougar's view of Dodge Caravan's approach path at 15 meters (50 feet).

25. View of the POI.

26. View of the post crash trajectory of the Mercury Cougar.

27. Look back view of the from the Mercury Cougar's rest position.

28. Frontal damage to the Dodge Caravan.

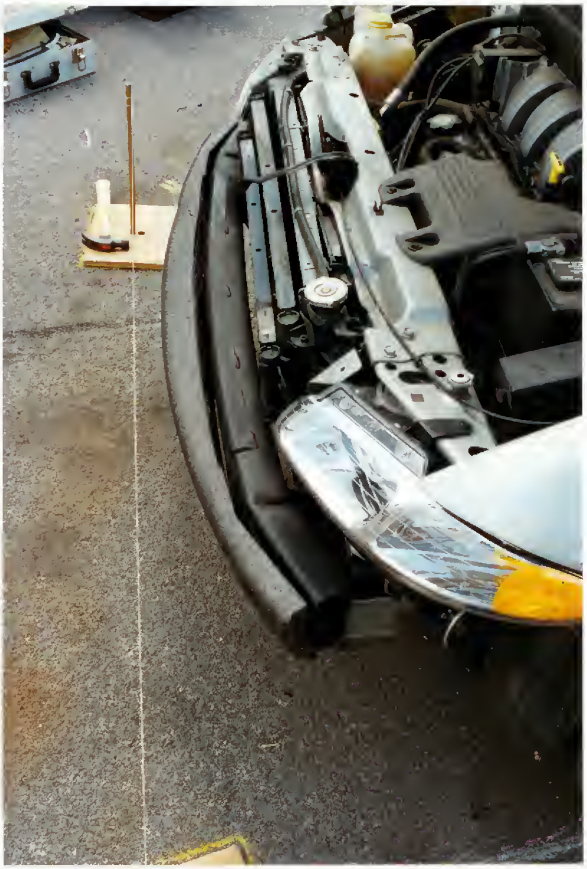


29. Right side longitudinal view.

30. View of the direct contact damage to the Dodge Caravan.

31. Left lateral view of the frontal crush to the Dodge Caravan.

32. Front view of the Dodge Caravan with the bumper fascia removed.



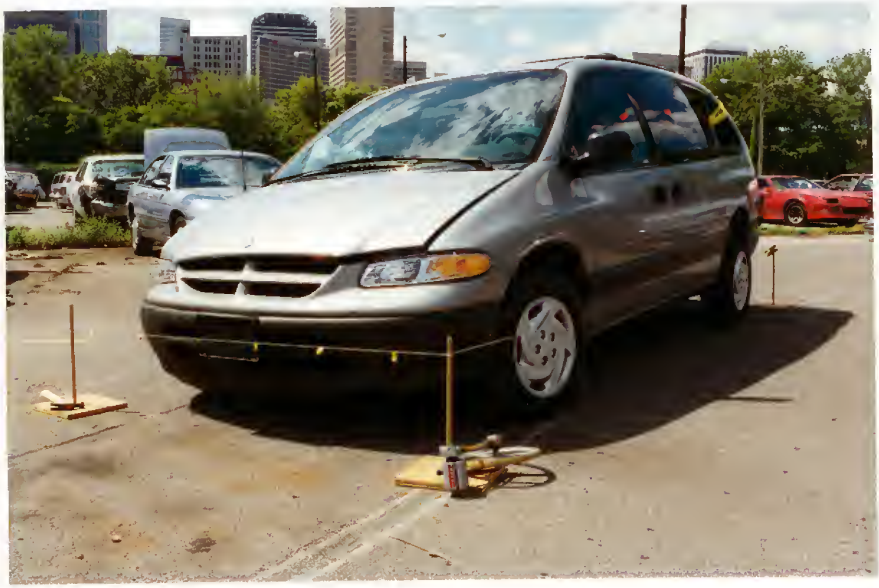
33. Lateral view of the Dodge Caravan bumper reinforcement bar.

34. Front view of the damage to the lower surface of the bumper fascia.

35. Ground view of the right corner of the front bumper fascia.

36. Close up view of damage to the lower surface of the bumper fascia.

37. View of the forward undercarriage of the Dodge Caravan.



38. Left front three-quarter view.

39. Left side view of the Dodge Caravan.

40. Left rear three quarter view.

41. Rear view of the Dodge Caravan.

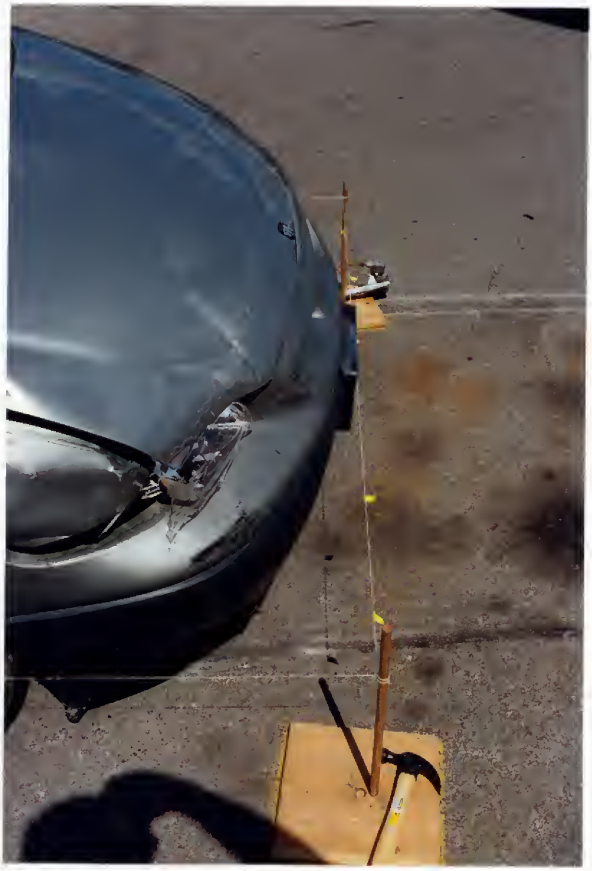
42. Right rear three quarter view.

43. Right side view.

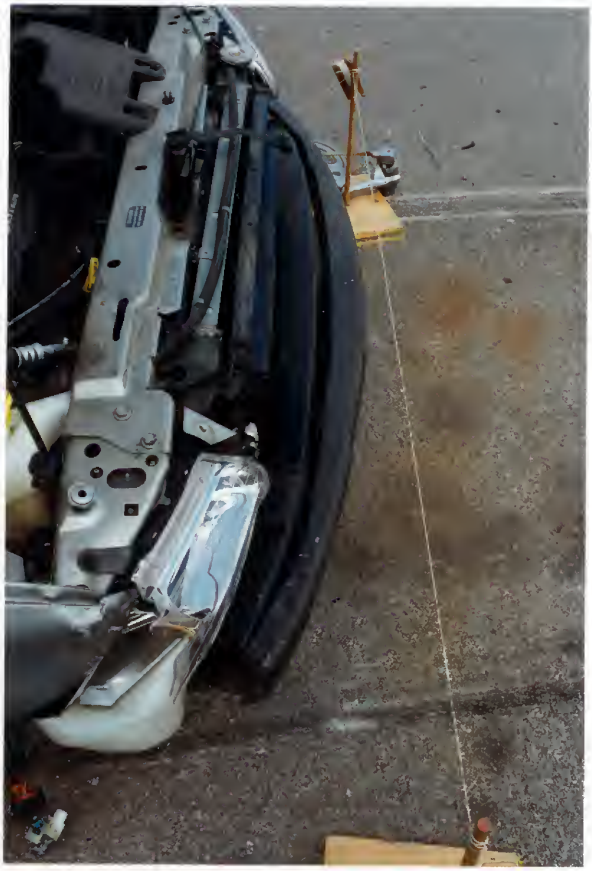
44. Right rear side slap damage to the Dodge Caravan.

45. View of the right side direct contact damage.

46. Right front three quarter view.



47. Right lateral view of the damage to the front of the Dodge Caravan.



48. Right lateral view with the bumper fascia removed.

49. Angular view of the driver's compartment.

50. Left side view of the front occupant space.

51. View of the steering wheel and the lower module cover flap. Note, the steering wheel is rotated 180 degrees.

52. Overall view of the deployed driver side air bag.

53. Close-up view of blood spatters on the lower left quadrant of the air bag.

54. View of the driver side knee bolster.

55. View of the driver seat track position.

56. Overall view of the driver seat and restraint.

57. Close-up view of the left front D-ring.

58. View of the left front seat belt's latch plate.

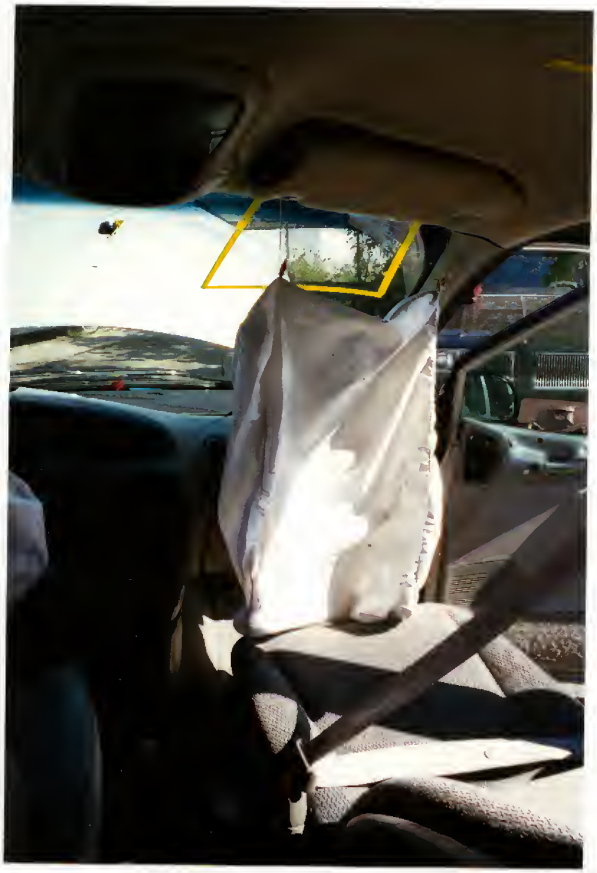
59. View of an abraded area on the plastic covering the latch plate.

60. Right side view of the forward occupant compartment.

61. Right perpendicular view of the instrument panel.

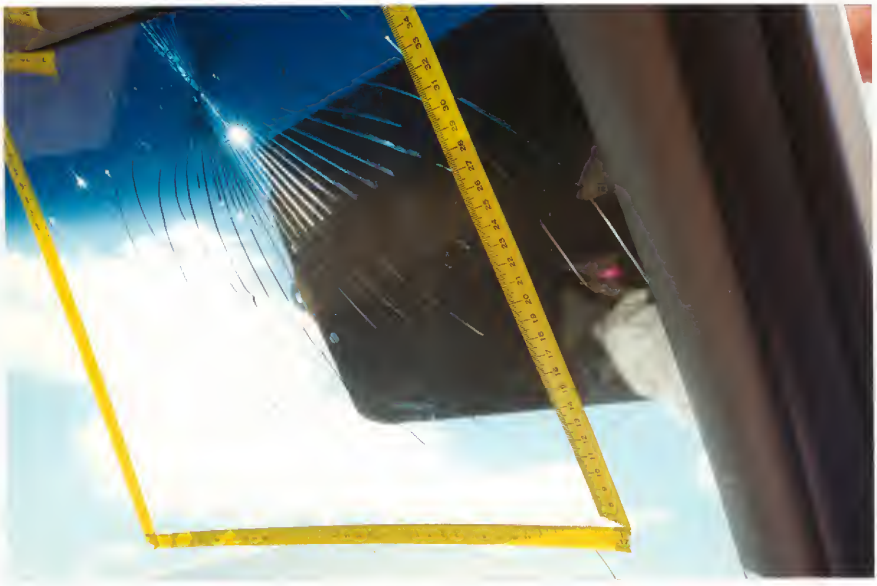
62. Overall view of the mid-mount passenger side air bag module.

63. Overall right side view of the air bag in simulated deployment.



64. Overall front view of the passenger side air bag.

65. Overall view of the windshield fracture caused by the deploying passenger side air bag.



66. Right view of the windshield fracture and air bag fabric transfers.

67. Close-up view of the windshield fracture and the air bag fabric transfers.

68. Close-up view of a fabric abrasion on the header/headliner.

69. Overall view of the face of the passenger side air bag.

70. View of blood spatters on the face of the air bag at the 12 o'clock position.

71. Close-up view of the blood spatters at the 12 o'clock position.

72. View of the blood spatters on the center and right side of the passenger air bag.

73. View of the lower portion of the face of the passenger air bag.

74. View of a gray vinyl transfer on the lower left quadrant of the air bag.

75. Close-up view of the vinyl transfers.

76. Close-up view of the vinyl transfers.

77. View of the headliner above the right front occupant's seat.

78. Close-up view of the blood spatters on the headliner.

79. View of the avulsed tooth found on the left side of the instrument panel.

80. View of the lower passenger side air bag module cover flap.

81. Right view of the extended passenger side air bag.

82. View of the rearward extension of the passenger side air bag.

83. Longitudinal measurement of the position of the seat relative to the instrument panel.

84. Longitudinal measurement of the seat relative to the deployed passenger side air bag.

85. View of the right front seat location.

86. View of the right front D-ring location.

87. View of blood spatters on the right front restraint webbing.

88. View of the abraded plastic on the right front latch plate.

89. View of a fluid spill on the right front restraint webbing.

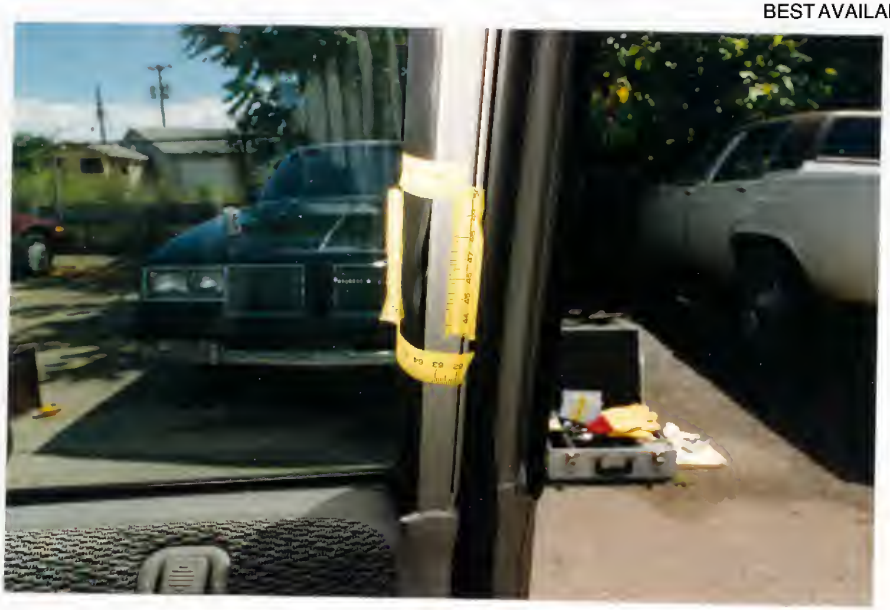
90. View of a fluid spill on the right front restraint webbing.

91. View of a fluid spill on the right front restraint webbing.

92. View of the fluid spill. Note, this is the reverse side of the webbing.

93. View of a rebound contact at the right B-pillar/window juncture.

94. Close-up view of the rebound contact.



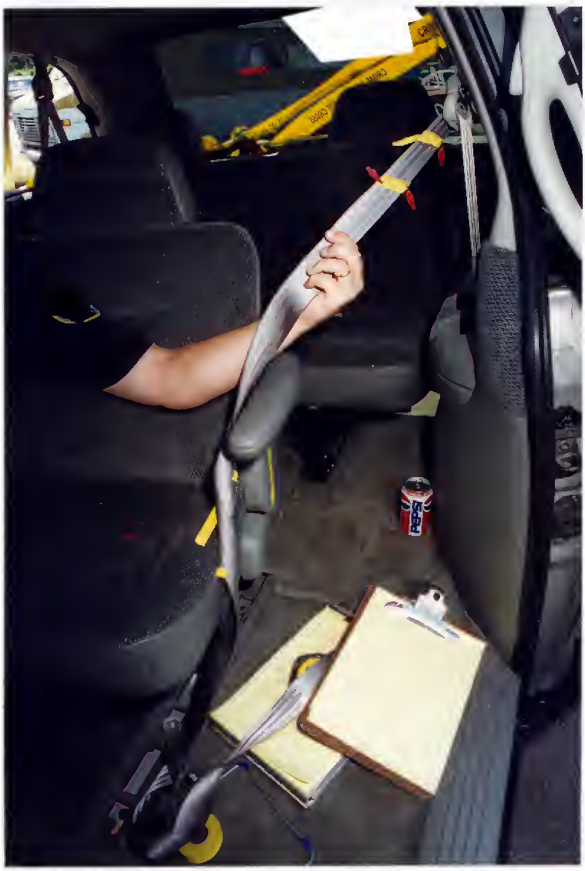
95. Close-up view of the rebound contact.

96. View of the right sun visor.

97. Left side view of the second seat of the Dodge Caravan.

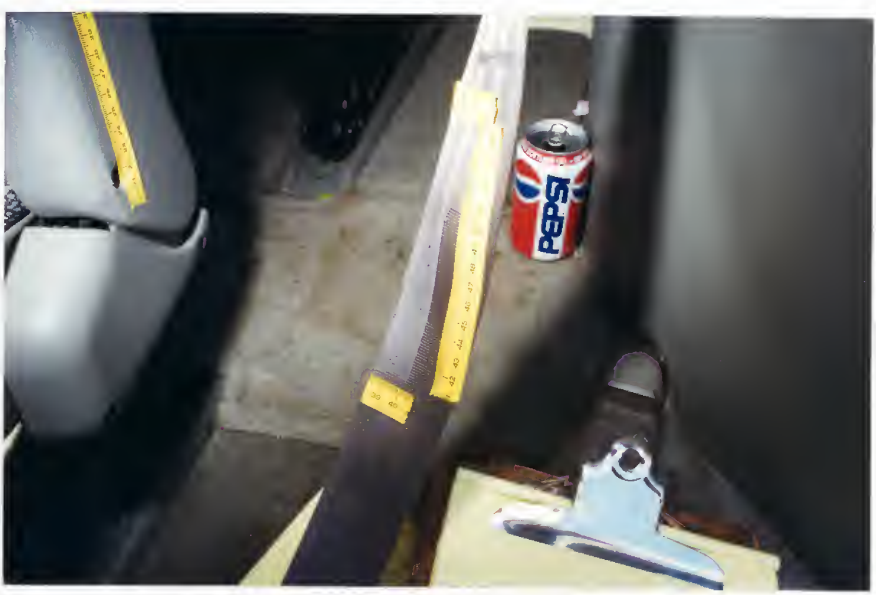
98. View of the second seat's left side floor mount.

99. View of a contact to the left front seat back.



100. View of the restraint webbing for the left side second seat occupant.

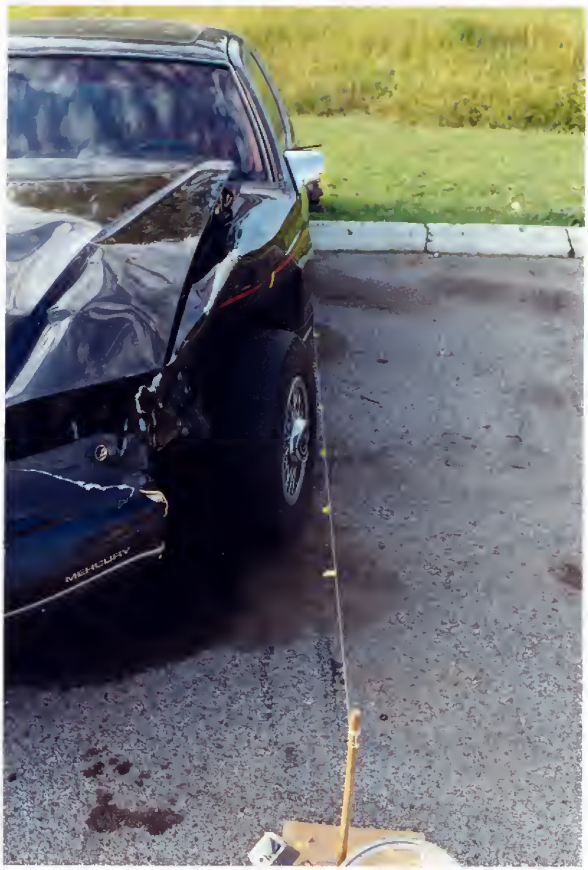
101. Close-up of an abrasion on the upper portion of restraint webbing near the D-ring.



102. Close-up of an abrasion on the restraint webbing caused by the plastic cover.

103. Close-up of the abraded surface of the second seat's hinge cover.

104. Front view of the 1988 Mercury Cougar.



105. Left side longitudinal view of the Mercury.

106. Left front three-quarter view of the Mercury.

107. Close-up view of the direct contact damage.

108. Left side view of the direct contact damage.

109. Overhead view of the deformation.

110. Left side view of the Mercury.

111. View of the primary contact deformation.

112. Left side view of the secondary (side slap) damage.

113. Left rear view of the Mercury.